

The aim of this paper is to review the recent active solar thermal technologies that help reduce the energy demand for greenhouse climate control and achieve intensive crop production.

There are many horticultural agriculture facilities in China that utilize solar energy as the main heat source to raise the indoor temperature for optimal crop growth, such as Chinese solar greenhouses [1, 2] northern China, the total heat storage in a greenhouse is limited by the outdoor temperature, solar radiation intensity and duration, and the heat storage ...

In addition, studies on the application of ST systems and STES in the agricultural sector have recently been conducted [[20], [21], [22]]. Semple et al. [20] conducted a techno-economic analysis of solar thermal and borehole seasonal thermal energy storage for greenhouses and found that 7 years of payback period are achievable with 70% subsidy when ...

4.1.1.1.1 Solar thermal storage. Solar thermal energy is usually stored in the form of heated water, also termed as sensible heat. The efficiency of solar thermal energy mainly depends upon the efficiency of storage technology due to the: (1) unpredictable characteristics and (2) time dependent properties, of the exposure of solar radiations.

Other research [61] introduced a renewable hybrid system integrating solar thermal energy and seasonal thermal energy storage to a greenhouse. COP of GSHP during the cooling season was measured at 5.0. Furthermore, the solar thermal system demonstrated an efficiency of 36.6 % during the trial period, while the tank-type seasonal thermal energy ...

Sustainability 2021, 13, 7025 4 of 32 Figure 2. Categorization of solar-powered dryers, adapted from refs. [19,40,41]. 2.1. Open Sun Drying Figure 3 illustrates the functioning of the open-sun-drying method in which solar

1 &#0183; In this study a solar collector field in Tallinn is modelled and possible location is proposed and different scenarios using produced solar energy are investigated, such as using solar ...

A thermal storage system can utilize the solar energy and excess thermal energy that is generated throughout the day and can be stored for either short or seasonal periods [25]. Both

The model established in their study covered 45% of the thermal energy demand for a greenhouse with a one-acre area in Ontario, Canada using a 600 m<sup>2</sup> flat-plate solar thermal collector positioned at 42°N, working fluid of a 1:1 mixture of propylene glycol and water, and 25 m<sup>3</sup> cylindrical storage tank with methyl eicosanoate as the PCM. The ...

A Chinese solar greenhouse (CSG) is used as a horticultural facility that provides high efficiency thermal storage performance to produce vegetables in winter. Quantifying the thermal performance of the surrounding structure including the back roof, soil, and north wall is helpful to improve the thermal performance of the CSG. The objectives of this study were to ...

The concept of stored excess energy inside the greenhouse, such as the use of the rock beds [], has been developed due to the need of developing heating systems for greenhouse based on renewable energy sources. Bouadila et al. [1400] carried out an experimental study of two insulated solar greenhouses. One greenhouse was attached with latent heat ...

Experimental investigation of a solar thermal storage heater assembled with finned heat pipe and collective vacuum tubes. *Energy Conversion and Management*, 166 (2018), ... Performance analysis of a latent heat storage system with phase change material for new designed solar collectors in greenhouse heating. *Solar Energy*, 83 (12) (2009), pp ...

Greenhouses consume a great deal of energy to heat their building envelopes. The strategic integration of solar energy and thermal energy storage (TES) can help to boost energy performance and reduce the carbon emission in the sector.

Xiaodan Zhang, Jian Lv, Mohammed Mujitaba Dawuda, Jianming Xie, Jihua Yu, Yantai Gan, Jing Zhang, Zhongqi Tang, Jing Li, Innovative passive heat-storage walls improve thermal performance and energy efficiency in Chinese solar greenhouses for non-arable lands, *Solar Energy*, Volume 190, 2019, Pages 561-575, ISSN 0038-092X, DOI: 10.1016/j.solener ...

The thermal characteristics of a solar greenhouse wall have an important influence on the creation of the microclimate in the greenhouse and improving the heat storage capacity of the wall ...

A Techno-economic Analysis of Seasonal Thermal Energy Storage for Greenhouse Applications, *Energy and Buildings*, Vol. 154, pp. 175-187, 2017. ... roof solar collector and high temperature attic ...

In the present work, the performance of a combination of two systems i.e. rock-bed thermal energy storage and water filled passive solar, for heating canarian greenhouse was analyzed and discussed.

A volumetric heat capacity comparison chart showing why water barrels are a superior option for thermal mass in a passive solar greenhouse. This image is from Page 174 of the book, *The Year Round Solar Greenhouse*, which Ryan highly recommends to anyone interested in building a greenhouse similar to his. Thermal lag is the rate at which a material ...

New insights of designing thermal insulation and heat storage of Chinese solar greenhouse in high latitudes and cold regions Xingan Liu a, b, d, Xiaoyang Wu a, b, d, Tianyang Xia a, b, d, Zilong ...

Flat-plate collectors are the most common and widely used type of solar thermal collectors. They consist of a flat, insulated box with a dark absorber plate covered by a transparent glass or plastic cover. The sunlight passes through the transparent cover and is absorbed by the plate, which heats up and transfers the heat to a fluid flowing through tubes or ...

3 &#0183; The EU project PROMETEO has the scope of testing a 25 kW solid oxide electrolysis system integrated with a concentrated solar power plant via thermal energy storage in a ...

Further, the selection and usage of solar photovoltaic panels and thermal energy storage units in the solar greenhouse dryers for achieving continuous and grid-independent drying are discussed in ...

The optimal solar collector and thermal storage sizing was assessed in [25] for a night heating of a greenhouse with solar thermal collectors and water tanks, calibrating and validating a tank temperature model capable to predict water temperatures in the storage tank with an average accuracy of 0.4 &#176; C, resulting in greenhouses ground area ...

The strategic integration of solar energy and thermal energy storage (TES) can help to boost energy performance and reduce the carbon emission in the sector. In this paper, ...

To improve the thermal performance, storage and saving heat solar energy of conventional greenhouse, a passive solar greenhouse was built which its north wall was made of soil.

Thermal energy storage (TES) can help to integrate high shares of renewable energy in power generation, industry and buildings. This outlook identifies priorities for research and development.

The front roof of the solar greenhouse captures more solar radiation energy, the height of the rear wall exposed to direct sunlight is high and the last row of crop canopy receives direct sunlight ...

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